EXCHANGE RATE DEVALUATION, ECONOMIC GROWTH AND PRICE STABILITY IN NIGERIA

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ABSTRACT
The study explores the relationship between devaluation and growth in Nigeria using time series data from 1991 to 2023. The estimating techniques are both the Autoregressive Distributed Lag model and Granger causality test. Two models are developed for this study. The first model of ARDL explores the influence of currency devaluation on economic growth using exchange rate as the proxy for devaluation and it is one of the independent variables. Gross Domestic Product growth rate is used to represent economic growth. The second estimating technique of Granger causality tries to see whether exchange rate devaluation would lead to price instability. Results indicate no significant effect of real exchange rate on growth rate of GDP. Exchange rates Granger causes consumer price index. The study recommends that the authority should provide the enabling environment that would encourage local businesses and boost domestic production so as to ease pressure on foreign exchange.
Keywords: ARDL, consumer price index, exchange rate, Granger causality
JEL Codes: F31, F41, O47

1. INTRODUCTION
Over four decades Nigeria has witnessed different regimes of exchange rate policies with the intent of firming up the value of the domestic currency. The Nigerian exchange rate has experienced significant fluctuations over the years. The exchange rate was N0.62 to $1 in 1973 but fell to N778.60 to $1 as of September 2023. (Businessday, 2023). Theoretically exchange rate devaluation should make the exports of the devaluing country to be cheaper while its imports is supposed to be more expensive. However, because of the structure of Nigerian economy which is more import dependent, devaluation often comes with general high level of prices even for domestically produced goods and services. This is due to the fact that some locally produced goods depend on imports in their manufacturing or production process. Exchange rate due to devaluation continues to aggravate the economic growth with its attendant high level of prices. Continuous efforts of the government at devaluing the exchange rate to correct balance of payment problems in some cases exacerbates the economic situation that they are trying to correct. Scholars have written extensively on exchange rate devaluation. Momodu and Akani (2016) observed that devaluation of the Nigerian currency leads to price instability. Inflation, exchange rate and net foreign direct investment have negative impact on economic growth in Nigeria (Iheanachor & Ozegbe, 2021). Devaluation of Nigerian currency as a lone policy is not favorable to the Nigerian economy (Lotto, 2018). Real exchange rate has the tendency to influence economic growth in the short run within the framework of other monetary economic variables (Akpan & Atan, 2011). Continuous depreciation of the domestic currency aggravates the general price level thereby causing imported inflation (Eze & Markjackson, 2020). High exchange rate has put pressure on inflationary level in Nigeria creating imported inflation (Njoku & Nwaimo, 2019).
Looking at all the papers on exchange rate it would be discovered that only Iheanachor & Ozegbe, 2021 investigates the link between economic growth as the dependent variable and

exchange rate as one of the independent variables. However, the paper did not look at price stability as another variable being affected by exchange rate. Moreover, the present analysis as against that of Iheanachor & Ozegbe, explores the Granger causality between exchange rate and consumer price index which is a proxy for price stability. This marks the difference between the present paper and that of Iheanachor & Ozegbe. The remainder of the paper is structured thus: The next section is on the review of the literature. Section three contains theoretical framework which is followed by data and methodology in section four. Section five details on discussion of results while the final section concludes.

2. LITERATURE REVIEW

2.1 Theoretical Literature

The general perception before the advent of Dornbusch (1976) paper was that exchange rate fluctuations is as a result of inefficient management of exchange rate. However, Dornbusch shows that when prices are rigid or fixed in the short run, with unanticipated increase in money supply, the exchange rate would be large or overshoot. The implication is that an increase in money supply leads to more than increase in exchange rate depreciation. When prices are gradually changing in the long run, this would move the system back to equilibrium. The process is that when money supply increases, with a fixed price and output in the short run, supply of real balances would have to increase too. It is expected that the domestic price of bond has fallen which would make way for an increase in the demand for real balances. This would lead to the appreciation of the domestic currency and in the long run the system would equilibrate. The initial overshooting which is depreciation in the short run has led to a balancing of the system in the long run when prices are allowed to change gradually to monetary policy shocks.

However, Mussa (1986) however argues that if increase in domestic prices have a strong negative impact (as a result of unanticipated increase in money supply) on money demand, then the exchange rate may not increase by large amount for it to overshoot.

2.2Empirical Review

Using Autoregressive Distributed Lag (ARDL) model, Iheanaghor and Ozegbe (2021) opine that increase in exchange rate, net foreign direct investment and inflation would hurt economic growth in the long run in Nigeria. The study uses growth rate of the Gross Domestic Product to proxy for economic growth. Uchechi and Iheukwumere (2022) are of the views that foreign trade exerts influence on economic growth in Nigeria. This was established in an investigation of times series data from 1987 to 2018. Analyzing the impact of foreign exchange, import, export and openness on Gross Domestic Product, the study concludes that increase in foreign exchange would reduce economic growth and reducing foreign exchange would increase growth in Nigeria. Meniago and Eita (2017) suggest that there is a relationship between exchange rate of the sub-Saharan African countries and their imports implying that these countries rely so much on imports. However, the study could not find any meaningful relationship between exports and exchange rate depreciation in these countries. The paper uses panel data from 1995 to 2012 for 39 selected sub-Saharan African countries (SSA). Njoku and Nwaimo (2019) submit that exchange rate volatility has a major bearing on inflation rate in the country. This comes from investigating the relationship between exchange rate changes and inflation in Nigeria for the period of 1981 to 2015. The estimating technique is Vector Error Correction Mechanism using Time Series data. Oyovwi (2012) in measuring the effect of exchange rate volatility on economic growth concludes that economic growth reacts positively to exchange rate volatility. In the long run however, the relationship is negative. The paper uses data from 1970 to 2009. It employs Generalized Autoregressive Conditional Heteroscedasticity (GARCH) as the estimating technique. However, it only measures volatility among relationship

and does not measure a long-term relationship. Onuorah and Osuji (2014) investigated relationship between exchange rate, economic growth inflation and interest rate in Nigeria using data from 2000 to 2010. The techniques of estimation are Ordinary Least Square method and Granger causality. It concludes that there is a relationship between exchange rate and economic growth. The study like that of Ani and Udeh (2021) also suffers from insufficient period of data analysis in terms of time series data. In order to estimate any model using time series, the rule is that the period of analysis must not be less than thirty years.

Michael, Eyamba, Amoke, Anakwue and Akadile (2025) investigate the impact of exchange rate fluctuation on some selected agricultural exports commodities in Nigeria using Non-linear Autoregressive Distribution Lag model (NARDL). Result indicates positive relationship between currency fluctuations and some agricultural products while it is negative in others. Overall, the study finds minimal impact of exchange rate volatility on the selected agricultural commodities. It is recommended that the policy makers should create the enabling environment that would boost the growth of exports in Nigeria. Lotto (2018) suggests that devaluation of the Nigerian currency is not the right policy option for the economy. The author uses time series data from 1985 to 2016. The estimating technique is OLS and adopting the elasticity approach through the export and imports demand equation, result suggests that summing up both the imports and export coefficient of relative prices is less than one (1). Research conducted by International Monetary Fund (IMF) staff (2004) between 1997 and 2002, it was discovered that Nigeria adopted a free-floating exchange rate system. This system led to volatility of price levels that exacerbates inflationary pressure. Odionye and Chukwu (2021) investigates the asymmetric effects of devaluation on economic output between 1980 and 2019 for six selected sub-Saharan African countries. The estimating technique employed is the Smooth Transition Regression is the estimating technique that is employed to investigate the relative asymmetric responses of economic output to devaluation and non-devaluation periods. The findings are mix for these countries. While devaluation asymmetrically responded positively significant for some it was insignificant for both Nigeria and Malawi. This is as a result of structural differences of each country.

Eze and Markjackson (2020) submit that continuous increase in foreign exchange would aggravate the general price level and lead to imported inflation. The study uses a time series data covering 1990 to 2018 and employs Error Correction Technique to determine the impact of exchange rate on the general price level. Aderemi *et al.*, (2019) examine the relationship between exchange rate and some monetary policy instruments such as credit reserves ratio treasury bills and monetary policy rate using Autoregressive Distributed Lag (ARDL) model. Result indicates that credit reserve requirement and Treasury bill have negative relationship with exchange rate. However, monetary policy rate which is the interest rate move in the same direction with the exchange rate during the period of investigation. Adeoye and Sabiu (2014) portend that the management of exchange rate in Nigeria has not been supported by appropriate monetary policy actions. The study investigates the impact of monetary policy shocks using selected monetary policy instruments on exchange rate changes in Nigeria. The estimating techniques are the classical ordinary least square method and the Granger Causality test. Finding indicates that the log run monetary policy shocks affect real exchange rate with feedback effect.

Omebere, Ezenekwe, Uzoechina and Nwokoye (2024) observe that there is positive relationship between exchange rate and economic growth in Nigeria. This is as a result of time series data analysis from 1980 to 2022. The study uses ARDL including different macroeconomic variables like gross fixed capital formation and unemployment as the

independent variables against GDP growth rate as the dependent variables. The result indicates a positive relationship between exchange rate and economic growth.

3. METHODOLOGY

The data is derived from the World Development Indicators of the (WDI) ranging from 1991 to 2023 that is 33 years. The study employs both ADRL model and Granger causality to investigate the long run impact of devaluation on economic growth and also the long run effects of the same devaluation on price stability. The two objectives are modelled separately to get a clear-cut picture. The study uses the ARDL as the technique because of its applicability notwithstanding the order of integration of the series. The Error Correction Model (ECM) can be developed from ARDL model through a simple linear alteration that integrates short run modifications with long run equilibrium without losing long run information. The related ECM takes a sufficient number of lags to capture the data generating processes. Another advantage is that the ARDL assumes that only a single reduced form equation exists between dependent and independent variables. The method is also able to identify the cointegrating vectors in a situation where there are multiple cointegrating vectors.

3.1 Theoretical Framework

According to exchange rate theory of trade leading to economic growth and in line with Iheanachor and Ozegbe, 2021, the study uses economic growth model that is determined by exchange rate (proxy for devaluation), export and inflation. Two models are designed. Economic growth model investigates the influence of devaluation of the currency on growth while the second model is on how devaluation has impacted on consumer price index using Granger causality. The estimating technique for the first model is the Autoregressive Distributed Lag (ARDL) model. Granger causality is used to estimate the second model to determine whether devaluation causes price instability. The essence as stated in the objective is to see separately the impact of devaluation on economic growth and level of prices. The growth rate of Gross Domestic Product (GDPR) is the proxy for economic growth and it is the dependent variable. Other variables are real exchange rate (which is a proxy for devaluation), inflation and export and consumer price index measuring price stability. The the study uses data for 33 years ranging from 1991 to 2023. The data is sourced from World Development Indicator.

3.2 Model Specification

$$GDPR = (INF, LREER, LEXPT) \quad .. \tag{1}$$

$$LREER = (LCPI) \tag{2}$$

From equation (1) GDPGR (which is the GDP growth rate) is the proxy for economic growth, it is the dependent variable LREER is representing devaluation and it is the main independent variable for this study. The second model is on causality to determine whether exchange rate devaluation is causing high level of prices.

ARDL Procedure

The first stage in the ARDL estimation is to investigate the existence of a long run relationship between the variables using the Bound F-statistics test. The bound test is carried out on each of the variables as they stand as endogenous variable while others are presumed as exogenous. Actually, testing the relationship between the forcing variables in the ARDL model leads to hypotheses testing of the long run relationship among the underlying variables.

The ARDL ($p, q_1, q_2 \ldots . q_k$) model approach to testing for cointegration:

$$\Delta X_t = \partial_{01} + \sum_{i=1}^{k} \beta_1 \Delta X_{t-1} + \sum_{i=1}^{k} \beta_2 \Delta Y_{t-1} + \partial_1 X_{t-1} + \partial_2 Y_{t-1} + \nu_{1t} \qquad (3)$$

$$\Delta Y_t = \partial_{0i} + \sum_{i=1}^{k} \beta_1 \Delta Y_{t-1} + \sum_{i=1}^{k} \beta_2 \Delta X_{t-1} + \partial_1 Y_{t-1} + \partial_2 Y_{t-1} + \nu_{1t} \qquad (4)$$

k is the ARDL maximum lag order and is selected by the analyst. The F-statistic is carried out on the joint null hypothesis that the coefficients of the lagged variables ($\partial_1 X_{t-1,} \partial_1 Y_{t-1}$ or $\partial_1 Y_{t-1,} \partial_1 X_{t-1}$) are zero. ($\partial_1 - \partial_2$) is link to the long run relationship while ($\beta_1 - \beta_2$) are the short run dynamics of the model.

The hypothesis that the lag variables are zero can be tested thus:

Null hypothesis of no long run relationship is

$H_0 : \partial_1 = \partial_2 = 0$ (null, indicating that there is no long run relationship)

$Ha : \partial_1 \neq \partial_2 \neq 0$ (alternative hypothesis implying that there exist a long run relationship).

This is tested using F-statistic (Wald test) in equations (3) and (4). The distribution of the F-statistics is non-standard irrespective of the integration of the variables- I(0) or I(1). There are two sets of critical values. On one side it assumes that all the variables I(0). This is the lower bound that implies that there is no cointegration among the variables under consideration. The second one is to assume that all the variables are I(1). This is the upper bound indicating that all the variables are cointegrated. If the computed F-statistic is greater than the upper bound critical value, then H_0cannot be accepted, there is cointegration. If on the other hand the calculated F-statistic falls below the lower bound then H_0 would have to be accepted there is cointegration. If, however the value of the computed F-statistics falls between the lower and upper bound, then the result remains inconclusive.

The selected ARDL (k) model long run equation is:

$$Y_t = \alpha_0 + \sum_{i=1}^{k} \beta_1 X_{1t} + \sum_{i=1}^{k} \beta_2 X_{2t} + \sum_{i=1}^{k} \beta_3 X_{3t} + \sum_{i=1}^{k} \beta_n X_{nt} + \mu_{1t} \qquad (5)$$

X_s ($X_{1t,} X_{2t,} X_{3t} ..... X_{nt}$) are the independent variables or the long run forcing variables, *k* is the optimum lag order.

EC_t is the error correction term denoted by

$$EC_t = \varepsilon_t = y_t - \sum_{i=1}^{k} \wedge \theta_i x_{it} - \psi' w_t$$

The ECT is the speed of adjustment coefficient is derived as the error term from the cointegration models of (4) and (5) whose coefficients are obtained by normalizing the equation on X_t (3) and Y_t (4) respectively. The ECT shows how much of the disequilibrium is being corrected. In essence it is the extent to which any disequilibrium in the previous year is being adjusted in y_t. A negative coefficient implies a convergent while a positive coefficient is a divergence. The second technique that is used is Granger causality to determine whether devaluation causes price instability as represented by consumer price index.

The ARDL procedure starts with the conduct of unit root test. In spite of the fact that the bound test does not require unit root test, there is need to conduct this test to ascertain that the series are not of order two I(2). According to Pesaran *et., al* (2001) (the system would crash if it is of order I (2). The series are both I(0) and I(1).

The first step in the ARDL procedure is to conduct the unit root test

$$y_t = \partial y_{t-1} + u_t \quad (6)$$

It must be examined whether ∂ is one in which case it has a unit root against the alternative which is less than one. Philips-Perron method of unit root test is adopted here.

$$GDPGR_t = \alpha_t + \tau INFL_t + \varphi LREER_t + \vartheta LEXPT_t + \varepsilon_t \quad (7)$$

$$LCPI_t = LREER_t + \mu_t \quad (8)$$

From (7) GDPGR is economic growth, α_t is the intercept $\tau, \varphi, \vartheta,$ are all elasticity of economic growth with respect to inflation, real exchange rate, and export respectively.

$$GDPGR_t = \alpha_t + \sum_{i=1}^{p} \sigma_1 GDPGR_{t-1} + \sum_{i=2}^{q} \sigma_2 INFL_{t-2} + \sum_{i=3}^{q} \sigma_3 LREER_{t-3} + \sum_{i=4}^{q} \sigma_4 LEXPT_{t-4} + \varepsilon_t \quad (10)$$

The next thing is to re-parameterize the ARDL into error correction model:

$$GDPGR_t = \alpha_t + \theta_1 INFL_t + \theta_2 LREER_t + \theta_3 EXPT_t + \sum_{a=1}^{p} \beta_a \Delta GDPGR_{t-a} + \sum_{b=1}^{q} \tau_b \Delta INFL_{t-b} + \sum_{c=1}^{q} \varphi_c \Delta LREER_{t-c} + \sum_{d=1}^{q} \vartheta_d \Delta LEXPT_{t-d} + \omega ecm_{t-1} \quad (11$$

The long run consumer price model is presented thus:

$$LCPI_t = \beta_t + \sum_{i=1}^{p} \delta_1 LCPI_{t-1} + \sum_{i=2}^{q} \delta_2 LREER_{t-2} + \mu_t - -(12)$$

ω is the coefficient of error correction that measures the extent of adjustment back to equilibrium.

4. RESULTS AND DISCUSSION OF FINDINGS

From the result of the unit root test in Table 1 below it can be seen that all the series (except consumer price index) are of order one (1) that is they are all stationery after first difference. Exception is CPI that is stationery at level. In this case the ARDL technique can be used.

Table 1 Unit Root Test using Philips-Perron

Variables	Unit Root at Level			Unit Root after 1st Difference		
	t-statistics	p-value	status	t-statistics	p-value	Status
GDPGR	-2.847	0.192	I(1)	-16.500	0.000	I(1)
INFL	-2.769	0.218	I(1)	-8.647	0.000	I(1)
LREER	-2.676	0.252	I(1)	-4.911	0.002	I(1)
LEXPT	-1.898	0.632	I(1)	-5.506	0.001	I(1)
LCPI	-5.277	0.001	I(0)	-	-	I(0)

Source: Author's Computation

The long run ARDL (1,0,2,0) is selected based on Akaike Information Criteria using lag 2.

The long run economic growth model is presented:/

There is cointegration between economic growth and other variables (LREER, INFL, and LEXPT). The bound test result from Table 2 shows that the calculated F-statistics **(3.728) is greater** than the upper bound (**3.67**) at the 5 percent significant level.

Table 2 Estimate results of the Bound tests for Model

Test Statistics	Value	Significant level	Lower Bound I(0)	Upper Bound I(1)
F-Statistics	**3.728**	10%	2.37	3.2
		5%	2.79	3.67
		2.5%	3.15	4.08

Source: Authors calculation.

The maximum value among the series as display in Table 3 is inflation rate while the minimum is GDP growth rate. Most of the variables are positively skewed that is skewed to the right except export and consumer price index. The Jarque-Bera statistics is within the expected threshold as it is greater than 0.05 percent.

Table 3 Descriptive Statistics

	GDPR	INF	LREER	LEXPT	LCPI
Mean	4.017535	18.60876	4.632533	24.17692	4.137675
Median	4.195924	13.00697	4.611475	24.63486	4.248724
Maximum	15.32916	72.83550	5.609526	25.36124	6.263218
Minimum	-2.035119	5.388008	3.907556	21.78899	1.003504
Std. Dev.	3.728781	16.02940	0.376529	1.034508	1.327044
Skewness	0.518536	2.143506	0.571174	-0.817373	-0.548565
Kurtosis	3.900735	6.664365	3.659782	2.525105	2.747489
Jarque-Bera	2.594407	43.73332	2.392876	3.984643	1.742751
Probability	0.273295	0.000000	0.302269	0.136378	0.418376
Sum	132.5787	614.0892	152.8736	797.8385	136.5433
Sum Sq. Dev.	444.9219	8222.134	4.536782	34.24659	56.35345
Observations	33	33	33	33	33

Results from Table 4 indicate that devaluation as measured by exchange rate does not impact on economic growth in the long run. Increasing inflation by 1% would reduce economic growth by 0.2% in the long run. The error correction technique ECT indicates that 79 percent of the deviation from long run equilibrium would be corrected within the year. This indicates that the speed of adjustment is high.

Model 2 measures the price stability as a result of devaluation using Granger causality. The Granger causality result is indicated in Table 5.0 Findings reveal that exchange rate leads to consumer price index. The implication here is that increasing the exchange rate would lead to high prices in Nigeria. There is no feedback effect. Consumer price index does not lead to exchange rate. It is a one-way causation from exchange rate to consumer price index. The result of the stability test as indicated in Figure 1 and Figure 2 reveal that the model is stable over time. The cumulative sum and cumulative sum of square show that the model is stable over time since they are within the 5% required boundary.

Table 4 Long and Short run Estimates of the Economic growth using ARDL

Variables (GDPGR as the Dependent variable)	**Coefficient**	**Standard Error**	**t-statistics**	**probability**
LONG RUN ESTIMATES				
INFL	-0.213	0.068	-3.141**	0.004
LREER	0.536	2.252	0.237	0.814
LEXPT	-1.113	0.721	-1.543	0.135
SHORT RUN ESTIMATES				
INFL	-0.218	0.067	-3.141**	0.004
LREER (-1)	4.410	1.985	2.221*	0.030
LEXPT	-1.113	0.727	-1.543	0.135
ECT	-0.791	0.169	-4.663***	0.000

Diagnostic Test

Serial Correlation Test (X^2_{SC})	X^2= 0.129 (0.93)	**Normality Test** (X^2_N)	JB= 0.34 (0.84)
Heteroscedasticity Test (X^2_H)	X^2=4.942 (0.55)	**Functionality Test** (X^2_F)	F= 4.99 (0.03)

Note: (*) indicates that the estimated coefficients is significant at 1 % (***), 5% (**), and 10% (*). Also the diagnostic tests:X^2_N represents Normality test, X^2_{SC} is serial correlation,X^2_H is heteroskedasticity while X^2_F is functionality test. They are all significant at 5% .

Source: Author's Computation

Table 5 Granger Causality Test Result

Null Hypothesis	obs	F-statistics	Probability
LREER does not Granger cause LCPI	31	3.338	0.078
LCPI does not Granger cause LREER		0.071	0.792

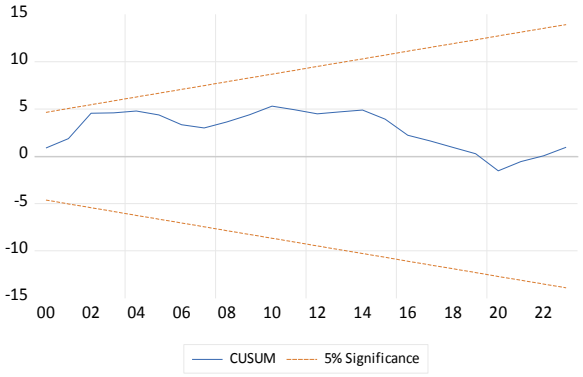

Figure 1 Cummulative sum for Economic growth model

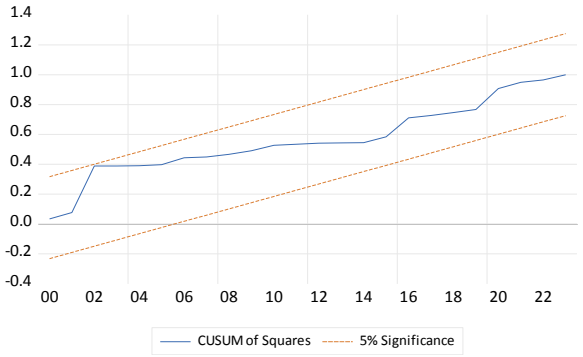

Figure 2 Cummulative sum of squares for Economic growth model

5. CONCLUSION AND POLICY RECOMMENDATIONS

The conclusion that can be derived from the finding is that GDP growth rate may be driven more by other factors like domestic consumption and investment to the extent that real exchange rate may not be able to significantly influence it. Furthermore, under an unstable exchange rate regime, it might not be possible for an analysis to discover a stable long-term relationship with GDP growth rate. Considering the Granger causality result where exchange rate leads to high prices, the policy makers should evolve a functional policy that would focus on locally produced goods in order to mitigate the effect of high import prices on the domestic price level. It is thus recommended that the government should rather focus on providing the enabling environment that would encourage local production. This should be followed by encouraging people to patronize the home-made products and discourage importation in order to ease the pressure on foreign currencies.

The government should take deliberate step to improve the infrastructure facilities which include transportation, roads, rail and others. It also includes electricity. Nigerians can do lot of things if the enabling environment are provided. Part of these enabling environment is to provide financial assistance in form of soft loans for genuine investors not giving preferences to political affiliates. Institutions which is the rule of law should be enforceable. No one should be above the law. Anyone finds culpable in any criminal activity should be dealt with accordingly.

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